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Standard Specification for Fusion Bonded Epoxy-Coated Pipe Piles[1]

This standard is issued under the fixed designation A 972/A 972M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers pipe piles with protective fusion-bonded epoxy powder coating applied by the electrostatic spray, flocking, or fluidized bed process.

NOTE 1—The coating applicator is identified throughout this specification as the manufacturer.

1.2 Other organic coatings may be used provided they meet the requirements of this specification.

1.3 Requirements for the powder coating are contained in Annex A1.

1.4 This specification is applicable for orders in either SI units (as Specification A 972M) or inch-pound units [as Specification A 972]. The values stated in either SI or inch-pound units are to be regarded as standard. Within the text, the inch-pound units are shown in brackets.

1.5 The following precautionary statement refers to the test method portion only, Section 8, of this standard: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 252 Specification for Welded and Seamless Steel Pipe Piles

B 117 Practice for Operating Salt Spray (Fog) Apparatus

D 4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser

G 8 Test Method for Cathodic Disbonding of Pipeline Coatings

G 12 Test Method for Nondestructive Measurement of Film Thickness of Pipeline Coatings on Steel

G 14 Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)

G 20 Test Method for Chemical Resistance of Pipeline Coatings

2.2 *American Petroleum Institute Specification:*

API RP 5L7 Recommended Practice for Internal Fusion-Bonded Epoxy Coating of Line Pipe[3]

2.3 *National Association of Corrosion Engineers Standards:*

TM0175 Visual Standard for Surfaces of New Steel Centrifugally Blast Cleaned with Steel Shot or Steel Grit (NACE No. 2)[4]

RP0490 Holiday Detection of Fusion-Bonded Epoxy External Pipeline Coatings of 250 to 750 µm (10 to 30 mils)[4]

2.4 *Steel Structures Painting Council Standards:*

SSPC VIS 1 Visual Standards[5]

SSPC-SP1 Surface Preparation Specification No. 1: Solvent Cleaning[5]

SSPC-SP10 Near White Blast Cleaning[5]

3. Ordering Information

3.1 Orders for pipe piles under this specification may include the following information:

3.1.1 Specification for designation and year of issue,

3.1.2 Size (pipe pile outside diameter and nominal wall thickness),

3.1.3 Quantity.

3.1.4 Length,

3.1.5 Portions to be coated (full length or distance from end),

3.1.6 Requirements for certifications (see 4.1 and 12.1),

3.1.7 Requirements for material samples (see 4.3),

3.1.8 Requirements for patching material (see 4.4),

3.1.9 Requirements for visual standards for surface cleaning comparison (see 5.1),

3.1.10 Requirements for test frequency (see 8.1, 8.2), and

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from the American Petroleum Institute (API), 1220 L St., Washington DC 20005.

[4] Available from the National Association of Corrosion Engineers (NACE), 1440 South Creek, Houston, TX 77084.

[5] Available from Society for Protective Coatings (SSPC), 40 24th St., 6th Floor, Pittsburgh, PA 15222-4656.

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3.1.11 Requirements for inspections at the manufacturing plant (see 10.1).

4. Materials and Manufacture

4.1 Steel pipe piles to be coated shall meet the requirements of Specification A 252 as ordered.

NOTE 2—Surface conditions such as slivers, gouges, laminations, pits, and sharp edges may cause coating application difficulties and effort should be made to hold these conditions to a minimum.

4.2 The powder coating shall meet the requirements listed in Annex A1 and shall be approved by the purchaser.

4.2.1 If specified in the order, a written certification shall be furnished to the purchaser that properly identifies the supplied powder coating, batch designation of each batch used in the order, quantity represented, date of manufacture, name and address of manufacturer, and states that the powder coating, meets the requirements of Annex A1.

4.3 If specified in the order, a representative 0.2 kg [8 oz.] sample from each batch of the powder coating shall be supplied to the purchaser. The sample shall be packaged in an airtight container and identified by batch designation.

4.4 Patching material shall be compatible with the powder coating and recommended by the manufacturer of the powder coating. If specified in the order, patching material shall be supplied to the purchaser.

5. Surface Preparation

5.1 Prior to blast cleaning, the surfaces of steel pipe piles to be coated shall be precleaned, as required, in accordance with SSPC-SP1. Steel surfaces shall be cleaned by abrasive blast cleaning to near-white metal in accordance with SSPC-SP10. The cleaning media used shall produce an anchor pattern profile of 38–100 µm [1.5–4.0 mils]. Either of the following visual standards of comparison shall be used to define the final surface condition: SSPC-VIS 1 or NACE TM0175. Expended blasting media debris and dust shall be removed from blasted surfaces prior to applying the powder coating.

5.2 Prior to application of the fusion-bonded epoxy powder coating, raised slivers, scabs, laps, sharp edges, or seams shall be removed using abrasive grinders. No individual area of grinding shall exceed 230 cm^2 [36 $in.^2$]. The total area of grinding shall not exceed 1 % of the total surface area.

NOTE 3—Pipe piles with excessive grinding should be reblasted prior to coating to establish a suitable anchor pattern in the ground area.

6. Coating Application

6.1 The powder coating shall be applied to the cleaned steel surfaces before visible oxidation occurs, but not exceeding 3 h after cleaning.

6.2 To achieve the required coating thickness (see 7.1), the steel shall be preheated prior to applying the powder coating in accordance with the powder coating manufacturer's written recommendations. The heat source shall not leave a residue or contaminant on the steel surfaces. If oxidation occurs, the steel shall be cooled to ambient temperature and recleaned before applying the powder coating.

6.3 The powder coating shall be applied and cured in accordance with the powder coating manufacturer's written recommendations.

6.4 Areas of pipe piles not requiring coating to allow for welding or other purposes shall be specified by the purchaser and shall be blocked-out during the coating application.

7. Requirements for Coated Pipe Piles

7.1 *Coating Thickness*:

7.1.1 The minimum coating thickness after curing on the pipe piles shall be 300 µm [12 mils].

7.1.2 The coating thickness shall be measured in accordance with Test Method G 12 following the instructions for calibration and use recommended by the thickness gage manufacturer.

7.2 *Coating Continuity*:

7.2.1 Holiday detection shall be performed on each coated pipe pile in accordance with NACE RP0490 or a 67.5 V direct current, 80-k Ω wet-sponge holiday detector in conjunction with a wetting agent.

7.2.2 Holidays detected shall be patched in accordance with the patching material manufacturer's written recommendations.

8. Test Frequency

8.1 Measure the coating thickness on a minimum of every 10th pipe pile.

8.2 Test the coating continuity over the entire coated surface of each pipe pile.

9. Permissible Coating Damage and Repair of Damaged Coating

9.1 Coating damage to pipe piles due to handling or other causes shall be repaired in the manufacturer's plant with patching material prior to shipment.

9.2 The areas of coating damage shall be prepared for the application of patching material by cleaning the damaged area, removing the damaged coating using grinders or other suitable means, feathering the adjacent coating, and removing all remaining residue or dust.

9.3 The application of the patching materials to the damaged areas shall be in accordance with the patching material manufacturer's written recommendation.

10. Inspection

10.1 The purchaser's representative (inspector) shall be allowed entry to the area of the manufacturer's plant where work on the purchaser's order is being performed during times of operation. The manufacturer shall afford the inspector all reasonable facilities to satisfy that the material is being furnished in accordance with this specification.

10.2 The inspector shall be allowed to select completed pipe piles randomly for inspection and testing in the manufacturer's plant. Such inspections and tests conducted by the inspector shall not interfere unnecessarily with the manufacturer's operation.

11. Rejection

11.1 Coated pipe piles represented by test specimens that do not meet the requirements of this specification shall be rejected. At the manufacturer's option, rejected sections shall be

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replaced, or may be stripped of coating, cleaned, recoated, and resubmitted for acceptance testing in accordance with the requirements of this specification.

12. Certification

12.1 Upon request by the purchaser, the manufacturer shall furnish, at the time of shipment, written certification that the coated sections meet the requirements of this specification.

13. Handling, Packaging and Shipping

13.1 Coated pipe piles shall not be dropped, dragged, or handled in any manner that will result in damage to the coating. Equipment for handling coated sections shall have padded contact areas.

13.2 Pipe piles shall be stored off the ground on supports that prevent excessive deflection. Stacked pipe piles shall be isolated with suitable separators to prevent coating damage.

13.3 Bundling bands for packaging and tie-down bands for shipping shall be padded or made of material that shall not damage the coating. Pipe piles shall be supported during shipping in a manner that prevents impact damage to the coating and excessive deflection.

14. Keywords

14.1 corrosion resistance; fusion-bonded epoxy powder coating; pipe piles

ANNEX

(Mandatory Information)

A1. QUALIFICATION OF ORGANIC COATINGS FOR PIPE PILING

A1.1 Scope

A1.1.1 This specification covers qualification requirements for a barrier epoxy powder coating for protecting pipe piling.

A1.2 Coating Material

A1.2.1 The coating material shall be a 100 % solids, heat curable, thermosetting, epoxy powder coating.

A1.2.2 At the request of the purchaser, the manufacturer of the fusion-bonded epoxy powder coating shall be required to certify that products used to coat pipe piling meet the requirements of this specification.

A1.3 Coating Requirements

A1.3.1 *Chemical Resistance*—The chemical resistance of the coating shall be evaluated according to Test Method G 20 by immersing coated plates in each of the following: distilled water, an aqueous solution of 3 *M* $CaCl_2$, an aqueous solution of 3 *M* NaOH, and a solution saturated with $Ca(OH)_2$. Specimens without holidays and specimens with intentional holes drilled through the coating 6 mm [¼ in.] in diameter shall be tested. The temperature of the test solutions shall be 24 ± 2°C [75 ± 4°F]. The minimum test time shall be 45 days. The coating shall not blister, soften, lose bond, or develop holidays during this period. The coating surrounding the intentionally made holes shall exhibit no undercutting during the 45-day period.

A1.3.2 *Impact Resistance*—The impact resistance of the coating shall be tested in accordance with Test Method G 14 using a 16 mm [⅝ in.] diameter tup, 300 µm [12 mils] minimum coating thickness on a 3 mm [⅛ in.] thick panel at 24 ± 2°C [75 ± 4°F]. Three tests shall be performed. The minimum acceptable value shall be 9 J [80 in.-lb.] of impact with no visible breaks in the coating.

A1.3.3 *Coating Flexibility*—The flexibility of the coating shall be evaluated by bending three 16 mm [⅝ in.] thick panels coated with a minimum of 0.3 mm [12 mils] of coating over a mandrel at 0 ± 2°C [32 ± 4°F]. Tests shall be performed in accordance with 5.3.3.1 of API RP 5L7 with an acceptance criterion of 1.5° total deflection at 0 ± 2°C [32 ± 40°F]. Bends shall be visually inspected; any visible tears or cracks in the coating at bends is cause for rejection, unless located with 2.5 mm [0.1 in.] of the edge of the strap. Unopened stretch marks on the coating surface do not constitute coating failure.

A1.3.4 *Abrasion Resistance*—The abrasion resistance of the coating shall be tested by a taber abraser (see Test Method D 4060), or its equivalent, using four standard steel plates for this apparatus coated to a thickness of 0.30 to 0.35 mm [12 to 14 mils] and CS-10 wheels with a 1-kg [2.2-lb] load per wheel. The maximum allowable weight loss shall not exceed 100 mg [0.0035 oz.]/1000 cycles. The abrasion wheels shall be cleaned after 500 cycles.

A1.3.5 *Salt Fog*—The weathering resistance of the coating shall be tested using a salt spray cabinet following Practice B 117 for 1000 h. The coating shall not blister, and the coating disbondment shall not exceed 3 mm [0.12 in], as measured from the edge of the scribe area.

A1.3.6 *Cathodic Disbondment*—The effects of electrical and electrochemical stresses on the bond of the coating to steel and on the film integrity shall be assessed in an elevated cathodic disbondment test. Test Method G 8 shall be followed except that flat plates coated with the proposed material shall be used. The drilled coating defect shall be 3 mm [0.12 in.] in diameter, the electrolyte solution shall be 3 % NaCl by mass dissolved in distilled water, the electrolyte solution temperature shall be 65 ± 2°C [150 ± 3.6°F], and the test duration shall be 24 hours. The average coating disbondment radius of three test panels shall not exceed 6 mm [0.24 in.] as measured from the edge of the intentional coating defect.

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